REMARKS

Claims 60-67 and 81-82 are pending in the application. Claims 68-80 and 83-98 have been withdrawn from consideration. Claims 60 and 82 are amended above. No new matter has been added to the application by way of these specification and claim amendments.

I. THE CLAIM 82 OBJECTION

The examiner objected to certain claim language used in claim 81. However, the language the examiner objects to is actually found in claim 82. So the Applicant assumes for purposes of this Reply that the examiner's objection is with claim 82.

The Applicant has overcome the examiner's objection by amending claim 82 above to more clearly set forth the structure of the hydrophone.

II. THE OBVIOUSNESS REJECTIONS

The examiner rejected claims 60-67 and 81 for being obvious over Brown (GB 2124784) in view of Bobb et al (US 5,639,968). Both Brown and Bobb describe apparatus for detecting deformation of a structure using optic fibre. In both cases, failure of the optic fibre indicates that a crack, or a predetermined level of strain, has occurred.

In complete contrast the present invention relates to hydrophones, using coils of optic fibre which undergo strain as a result of pressure waves acting upon them. Detection of the very low strain levels induced in the fibres is by measurement of the change in phase of an optical signal passing through the fibre coil. The fracture limit of the optical fibre is recited in present claim 60. However the fracture limit is not claimed as a sensing mechanism, but instead serves to define a physical relationship between the fibre and the support element of the invention.

Claim 60 is amended above to explicitly to recite "an optical hydrophone assembly" including "a plurality of optical hydrophone sensor coils". Neither Brown nor Bobb describe or in any way relate to a hydrophone assembly, or any hydrophone sensor coils and claim 60-67 and 81 are non-obvious for at least this reason.

The Examiner has drawn attention to Figure 4 of Brown, where a coil of optic fibre is shown mounted on a tubular member, each turn of the coil separated by a longitudinal length of

fibre. It is respectfully submitted that the four individual turns of fibre of Brown Fig. 4 cannot constitute the optical hydrophone sensor coils of the presently claimed invention. As is stated on page 13, lines 22-24 of the present specification, a hydrophone sensor coil generally consists of several layers of tightly wound optical fibre. Such an understanding follows from the function of hydrophone coils, which is to convert imposed strain into a change of phase of an optical signal. In order to produce a detectible change of phase, a significant length, and hence number of turns is required. In order to further clarify the distinction between Brown and the present invention, claim 60 is amended above to explicitly recite that the optical fibre hydrophone sensor coils are "responsive to imposed strain to produce a change in phase of an optical signal passing therethrough". There is no teaching or suggestion in Brown that the individual turns of Figure 4 are responsive to strain to produce such a phase change. Indeed it is considered that such an arrangement would be incapable, in practice, of performing such a function. For this reason as well, claims 60-67 and 81 are each patentably distinct over Brown, either alone or in combination with Bobb.

Claim 82 stands rejected over Brown and Bobb, in view of Frederick et al. (US 5,624,724). The Examiner suggested that "it would have been obvious... to incorporate the optical sensor apparatus suggested by Brown and Bobb in a hydrophone having a rigid mandrel as taught by Frederick". This is respectfully denied.

As noted above with respect to claims 60 et al., the cited prior art does not disclose all of the features of the invention and claim 82 is patentable at least by virtue of its dependency upon allowable independent claim 60.

Furthermore, it is considered that there would be no suggestion or motivation to combine the cited references as the examiner has in rejecting claim 82. Neither Brown nor Bobb describe a hydrophone assembly. The principle of sensing by detecting failure of the optical fibre of Brown and Bobb could not be further removed from the phase based sensing principle of the present invention. It is submitted that the person skilled in the art considering the design of a hydrophone assembly would have no motivation, desire or use for information concerning apparatus which detects deformation by sensing the failure of an optic fibre.

The only common ground between Bobb and/or Brown and Frederick is the use of optic fibre. The skilled person, considering Bobb and/or Brown, would be concerned with fracture or

strain detection, and the fracture limit of optical fibres. Sensing is performed on the structure to which the fibre is attached, not of the surrounding environment as in the present invention. There is therefore no possible connection with hydrophone. Similarly, the skilled person reading Frederick is concerned with the arrangement of a reference arm and sensing arm in an interferometric hydrophone arrangement. There would be no reason suddenly to consider fracture of the fibre, or sensing of strain in the mandrel on which it is wound. There is therefore no reason or motivation to consult Bob or Brown.

In the absence of any explicit analysis to the contrary, it is considered that it would not be obvious to combine the cited prior art.

Even if it was attempted to combine the teaching of these documents, it is respectfully submitted that the present invention would not result. There is no disclosure in Frederick of multiple hydrophone sensor coils mounted on an elongate support member. Frederick discusses only a single sensor coil and a single reference coil. The skilled person, wishing to join multiple such coils would use conventional means, as noted in the introductory part of the description.

If, however unlikely, Brown were to be considered in combination, it is considered that the skilled person would be led to modify the sensing coil of Frederick, to include some sort of detection of cracking in the mandrel. In other words the obvious combination (if there could be such a thing) would be to provide longitudinal portions within the sensing coil, and not to provide multiple sensing coils. Such progression is in fact taught explicitly in Brown, Figure 4 shown as being a modification of the single helical sensor of Figure 3. Furthermore, in order to achieve the function stated in Brown, the optic fibre must operate as one continuous sensing element. If the portions of Figure 43 of Brown were not part of the sensor, and were merely connecting portions, the stated objective of detecting cracks longitudinally would not be achieved For this reason as well, claim 82 is non-obvious and patentable over the cited prior art.

CONCLUSION

Pending claims 60-67 and 81-82 are non-obvious and patentable for the reasons recited above. Favorable reconsideration and allowance of all pending application claims is, therefore, courteously solicited.

Respectfully submitted,

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